

## PATENT SPECIFICATION

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## COMPLETE SPECIFICATION

### Improvements in or relating to the Reproduction of Images from Lenticulated Films.

We, TECHNICAL MOTION PICTURE CORPORATION, a corporation organized under the laws of the State of Maine, United States of America, of 110, Brookline Avenue, Boston, Massachusetts, 5 United States of America (assignees of HERBERT T. KALMUS and JOSEPH ARTHUR BALL, both citizens of the United States of America, and both of 110, Brookline Avenue, Boston, aforesaid), do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to the art of making colored pictures, either still pictures or motion pictures, involving the use of a film having a large number of small lenses associated therewith, usually a multiplicity of convex or cylindrical protuberances on one side thereof through which an emulsion, usually on the back of the film, is exposed in a camera having a focussing lens of the usual type and having color filters, usually three, over different portions of the diaphragm opening, to form in the emulsion behind each small lens a group of color records, the records of each group representing different color aspects of the scene corresponding to the aforesaid. Heretofore such films have been developed by a reversal process to convert them into positives, or have been printed on similar positive stock to form positives, for use in projecting pictures upon a viewing screen.

According to the present invention the color records contained in the single emulsion layer of such a lenticulated film are separated and each color aspect is recorded on a separate layer of emulsion whereby the pictures of each series forming a certain color record are approximately arranged in the same relationship to each other as the corresponding color record groups of the single negative emulsion of the lenticulated film. The color records which have been separated upon different emulsions, each single emulsion bearing only pictures corresponding to one color, may then be further utilized especially for

making subtractive color films, preferably by producing, with their aid, matrices for imbibition printing. 55

The objects of the present invention are to provide a method and apparatus for accurately and economically reproducing color records of the aforesaid type with which pictures may be projected by a subtractive process, that is by rays of light each passing successively through each of the color records in contradistinction to the prior additive method of projecting such picture records which involves projecting different rays of light through the different color records with the projected images superposed on the screen. 60 65

For the purpose of illustrating the genus of the invention a typical embodiment is represented diagrammatically in the accompanying drawings in which, 70

Fig. 1 is a diagram of an optical system for reproducing the records: 75

Fig. 2 is a diagrammatic representation of a small section of negative having spherical lenses;

Figs. 3, 4 and 5 are similar views of corresponding sections of three positives printed from the negative; and 80

Figs. 6, 7, 8 and 9 are like Figs. 2, 3, 4 and 5, respectively, except in that they represent the use of cylindrical lenses.

In the particular embodiment of the invention chosen for the purpose of illustration N represents the negative having on its front face small lenses 1 and on its rear face an emulsion 2 containing the aforesaid groups of component records R, G and B behind each lens. O is a projection lens through which the color records on the negative are projected upon the film P which would ordinarily be a positive film. This lens should be like the camera lens used in exposing the negative N except in that the camera lens is provided with red, green and blue filters covering the areas r, g and b respectively. The aperture of the lens O should be substantially the same as, or equivalent to, the aperture of the lens used in the camera in exposing the negative N through the lenses 1; and the position of the lens O should preferably be substantially in the conjugate focal plane of the lenses 1 or, if 85 90 95 100 105

the lens O is displaced from this focal plane, the aperture and the focal distance of the lens O should be changed so as to maintain the same ratio, so that the transmissions of the three color records shall remain in the original proportions. That is the effective F number of the lens O should be the same (or at least as small) as that of the camera lens through which the negative N is initially exposed; and the rear focal distance of the lens O should be approximately equal to the front focal distance of the lenses 1.

If light (preferably more or less diffused) be transmitted through the film N from the rear, the lens O will focus each of the records R, G and B in the same area on the film P. In order to expose the film according to either the red, green or blue records of the negative two of the three beams of light passing through the areas *r*, *g* and *b* respectively are obstructed by means of one of the three masks 3, 4 and 5 placed in or near the pupillary or diaphragming plane of the optical system. Thus when the mask 3 is in position light can only pass through the area *g*, thereby reproducing on the film P the green records G behind the lenses 1; when the mask 4 is in position the red records are transmitted; and when the mask 5 is in position the blue records are transmitted. Thus the records of the negative film representing the different color aspects of the scene may be separately reproduced on three positives by using the different masks 3, 4 and 5 in printing the different positives respectively.

The positives may be colored according to any known process and used in any suitable projection apparatus for producing color pictures by projection. However, the preferred way of using the positives is to convert each one into an imbibition matrix, or to use each film for printing a corresponding matrix, and then using the matrices to print the other film by imbibition according to known imbibition methods. It will be observed that the color record on each positive corresponding to one of the color records (R, G or B) on the negative will occupy a space substantially equal (or corresponding in relative size) to the space occupied by the entire group (R, G and B) on the negative. Thus the records on the positives would appear as indicated in Figs. 3, 4 and 5 if the lenses 1 be spherical, and in Figs. 7, 8 and 9 if the lenses be cylindrical, where R<sup>1</sup> represents the red records on one positive P<sup>1</sup>, G<sup>1</sup> the green records on positive P<sup>2</sup>, and B<sup>1</sup> the blue records on positive P<sup>3</sup>.

Another method of reproducing the negative components in different layers of

emulsion consists in using a positive film of the Monopack type having successive strata of emulsion approximately sensitized to the colors of the taking filters, so that the negative records representing the different color aspects of the scene are reproduced in different layers of the same positive with the aid of filters substantially similar to the taking filters without the use of shutters 3, 4 and 5, the images in the different layers then being differently colored, or separately reproduced and then colored. According to any convenient and practical methods which do not form part of the present invention. Still another method of reproduction consists in using three separate positive films according to Tri-pack practice, each sensitized to one of the three colors, and arranged in superposition at the location of film P in Fig. 1 so that the different color records of the negative are reproduced through appropriate filters in the different positive films respectively owing to the fact that the latter are differently sensitized.

Obviously the number and color and relative sizes of the taking filters *r*, *g* and *b* and of the filters used for reproduction upon monopacks or tripacks may be varied as desired, the number of minute records in each group depending upon the number of filters and the colors selected for the positives depending largely on the number and color of the filters.

Instead of using the original negatives in printing the positives, master negatives may be formed by converting the original negatives into positives as by reversal and printing the master negatives therefrom, or by converting prints from the original negatives into master negatives as by reversal or by printing master negatives from the positives obtained as described.

From the foregoing it will be evident that the positive print represents the faces of the lenticular elements 1 (as indicated by the arrows in Fig. 1) and that the component records R, G and B are imaged exclusively in the central plane of lens O.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. The method of making cinematographic films representing different color aspects of an object-field, with lenticular negative film having small lenses behind each of which the different color aspects are separately recorded in a group, characterized by separately reproducing the different color records of successive pictures

- in different layers of emulsion respectively with the records of each color aspect in approximately the same relationship to each other as the group areas of the negative bear to each other, whereby the different layers may be differently colored and/or differently treated to reproduce the object-field in approximately natural colors.
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- 10 2. The method according to Claim 1 further characterized in that said layers of emulsion are on different films respectively.
3. The method according to Claim 2 further characterized in that the different films are used to produce matrices by which color pictures are printed by imbibition. 15

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2<sup>nd</sup> Edition

[This Drawing is a reproduction of the Original on a reduced scale.]

